

# CASE STUDY

## The Poles

**Environment and Society** Earth's axis intersects its surface at the North and South Poles. The Poles are the same distance from the equator, and both have ice cap climates. However, the Poles also have varying geographic features. They and their surrounding regions offer unique opportunities for expanding human knowledge about our world.

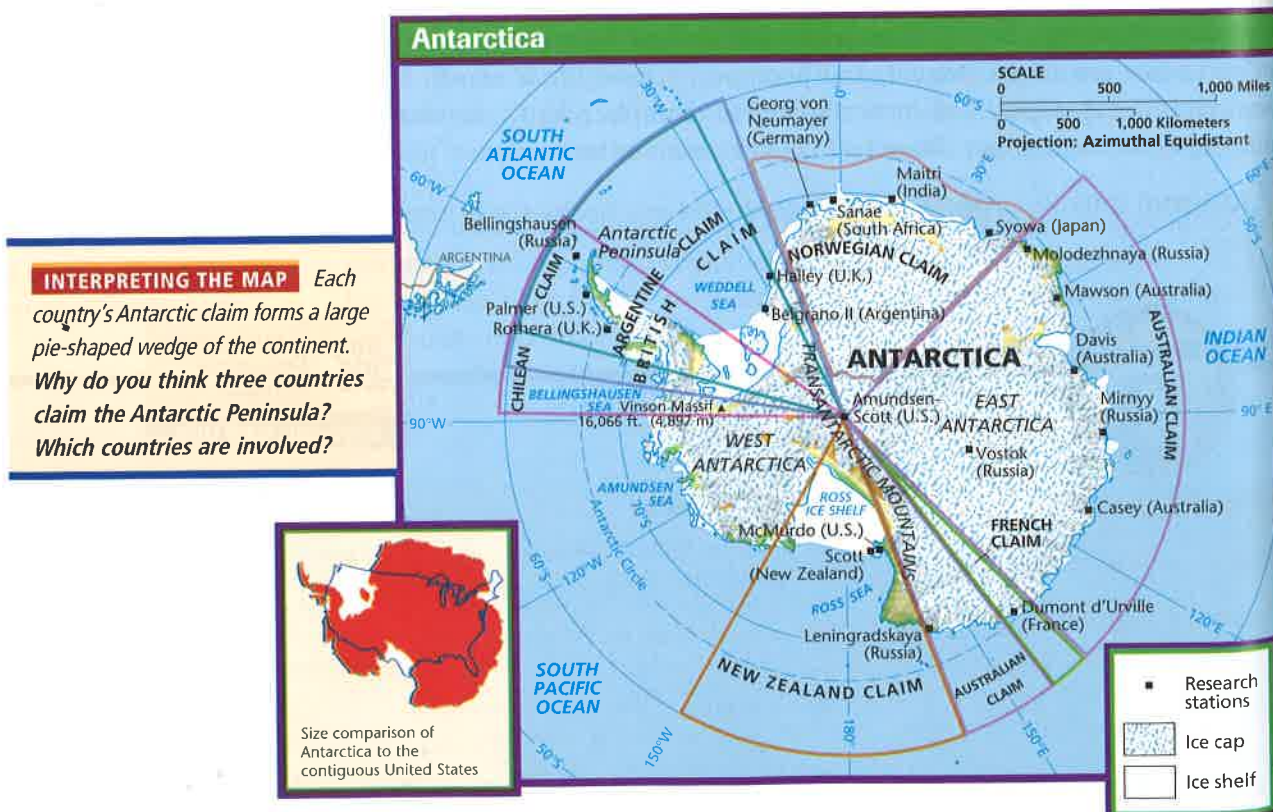
### A Frozen Land

The South Pole is in the heart of Antarctica—a continent buried under snow and ice. It is the coldest, driest, windiest, and most isolated continent on Earth. Antarctica also has the highest average elevation of any continent. Russian scientists recorded the world's lowest temperature there,  $-128.6^{\circ}\text{F}$  ( $-89.2^{\circ}\text{C}$ ). Even in the summer, the average temperature in Antarctica's interior stays far below freezing. The air is so cold that it cannot hold moisture. As a result, central Antarctica gets only 2 inches (5 cm) of precipitation per year. However, the ice has been building up for millions of years!

What does the bottom of the world look like? More than 95 percent of Antarctica's surface is ice. It is Earth's deep freeze, storing more than 90 percent of the planet's ice. Ice does not cover the Transantarctic Mountains, however. At 6,500 to 13,000 feet (2,000 to 4,000 m), these mountains break through the ice that blankets most of the continent. Mountains, plateaus, and valleys lie buried under the ice throughout the rest of the continent. Much of Antarctica's rock foundation lies under the frozen surface, some of it below sea level. If all of Antarctica's ice melted, parts of the continent would become island chains. In addition, without the weight of the ice pushing it downward, the underlying rock would rise.

### A Frozen Sea

The North Pole lies in the middle of the Arctic Ocean instead of deep within a continent. Asia, Europe, and North America surround the Arctic Ocean. A permanent layer of sea ice covers the ocean's center. During the warmest months of the year, when the





temperature hovers near freezing, the edges of this frozen crust melt. When winter cold returns, so does the ice.

Compared to the stable and thick Antarctic ice cover, Arctic ice is very thin and loose. Antarctic ice is typically thousands of feet thick. In contrast, Arctic ice averages only 10 to 16 feet (3 to 5 m) in thickness. Arctic ice floats in large chunks on the ocean's surface. Currents, tides, and wind push and pull the ice. Cracks and ridges spread. Large sections of ice collide, combine, break up, and collide again.

### Research at the Poles

Scientists have conducted research at both Poles for many decades. During the 1950s and 1960s American and Soviet scientists mapped the Arctic Ocean's floor from research stations on the ice. However, because Arctic ice is always changing, these stations were not permanent.

In contrast, Antarctic research stations have been more durable. Some 29 countries have sponsored research projects in Antarctica. These projects address a wide range of topics. Some scientists search the ice for meteorites that provide information about our solar system. Others have compared air trapped in ancient ice bubbles with today's air. They learned that the use of fossil fuels has raised the amount of carbon dioxide in the air to the highest levels in human history. Some researchers concentrate on how animals survive in the frigid climate of Antarctica and the waters surrounding it.

### A Harsh but Fragile Place

Antarctica is not immune to damage or change. For some time, people at research stations piled up trash and sewage and pushed it into the ocean. In addition, some energy companies have hoped to extract the



**INTERPRETING THE VISUAL RECORD** Bottom: The polar bear is at home in the Arctic Ocean and on land or ice. Top: At the North Pole, passengers from a Russian ship walk through all the time zones. Through which hemispheres could these people walk?

continent's store of oil and minerals. Oil spills have already caused environmental damage. In 1991, 32 countries forged an agreement to protect Antarctica. The agreement forbids most activities in Antarctica that do not have a scientific purpose. It bans mining and drilling and limits tourism.

Still, Antarctica is changing. Satellite images show that the continent's ice sheet is shrinking. In 2001, scientists found that since 1992 about 8 trillion gallons of water had melted from a glacier in western Antarctica. That is enough to cover about 23 million acres of land with about 1 foot of water. Scientists believe this finding is further evidence of global warming.

### Applying What You Know

- Summarizing** What are some of the important differences in the physical geography of the North and South Poles?
- Identifying Cause and Effect** How have humans modified the physical environment of Antarctica? How may global warming be affecting Antarctica?